COMMONWEALTH of VIRGINIA
DEPARTMENT OF ENVIRONMENTAL QUALITY
***DRAFT* PERMIT**
TO WITHDRAW GROUNDWATER IN THE
EASTERN VIRGINIA GROUNDWATER MANAGEMENT AREA

Permit Number: GW0009801
Effective Date: Xxxxxxx XX, 2023
Expiration Date: Xxxxxxx XX, 2038

Pursuant to the Ground Water Management Act of 1992 (Section 62.1-254 et seq. of the Code of Virginia) and the Groundwater Withdrawal Regulations (Regulations) (9VAC25-610), the Department of Environmental Quality hereby authorizes the Permittee to withdraw and use groundwater in accordance with this permit.

Permittee Aqua Virginia, Inc.

Facility Brookwood Manor Public Water System

Facility Address 7849 Woodbrook Road

Quinton, VA 23141

The Permittee's authorized groundwater withdrawal shall not exceed:

4,900,000 gallons per year,
700,000 gallons per month,

The permitted withdrawal will be used to provide for the operation of a private municipal water system. Other uses are not authorized by this permit.

The Permittee shall comply with all conditions and requirements of the permit.

By direction of the Department of Environmental Quality, this Permit is granted by:

Signed _____ Date _____

Scott Morris, DBA, P.E.
Director, Water Division

This permit is based on the Permittee's application submitted on October 29, 2021, and subsequently amended to include supplemental information provided by the Permittee. The following are conditions that govern the system set-up and operation, monitoring, reporting, and recordkeeping pertinent to the Regulations.

Part I
Operating Conditions

A. Authorized Withdrawal

1. The withdrawal of groundwater shall be limited to the following wells identified in the table below. Withdrawals from wells not included in Table 1 are not authorized by this permit and are therefore prohibited. 9VAC25-610-140 A

Table 1

Owner Well Name	DEQ Well #	Well Depth (ft bls)	Screen Intervals	Aquifer	Latitude	Longitude	Datum
Well #1	163-00008	305	285-305	Potomac	37° 31' 9.9"	-77° 10' 44.2"	NAD27
Well #2	163-00097	345	294-314	Potomac	37° 30' 59.5"	-77° 10' 49.7"	NAD27

2. Any actions that result in a change to the status, construction, or pump intake setting of wells included in this permit must be pre-approved by the Department of Environmental Quality (Department or DEQ) in writing prior to implementing the change and a revised GW-2 Form must be submitted to the Department within 30 days after the physical construction of a well is altered or the pump intake setting has been changed. If changes are a result of an emergency, notify the Department within 5 days from the change. 9VAC25-610-140 C

B. Public Water Supplies

1. Daily withdrawal limits set forth in this permit are consistent with the requirements and conditions of the Virginia Department of Health (VDH) Waterworks Operation Permit 4127055. 9VAC25-610-140 A 5

2. The Permittee shall submit copies of an updated Waterworks Operation Permit and the associated Engineering Description Sheets to the Department within 30 days of receipt from the Virginia Department of Health. 9VAC25-610-140 C

C. Pump Intake Settings

1. The Permittee shall not place a pump or water intake device lower than the top of the uppermost confined aquifer that a well utilizes as a groundwater source or lower than the bottom of an unconfined aquifer that a well utilizes as a groundwater source in order to prevent dewatering of the aquifer, loss of inelastic storage, or damage to the aquifer from compaction. 9VAC25-610-140 A 6

2. Pump settings in individual wells are limited as follows. Any change in the pump setting must

receive prior approval by the Department.

Owner Well Name	DEQ Well #	Max Pump Setting (feet below land surface)
Well #1	163-00008	263*
Well #2	163-00097	270*

*The pump intake limits were interpolated from the aquifer depth values from the **VAHydroGW**-VCPM **Model** in the Technical Evaluation.

D. Reporting

1. Water withdrawn from each well shall be recorded monthly at the end of each month and reported to the Department, in paper or electronic format, on a form provided by the Department by the tenth (10^{th}) day of each January, April, July and October for the respective previous calendar quarter. Records of water use shall be maintained by the Permittee in accordance with Part III.F, 1 through 5 of this permit. 9VAC25-610-140 A 9

2. The Permittee shall report any amount in excess of the permitted withdrawal limit by the fifth (5th) day of the month following the month when such a withdrawal occurred. Failure to report may result in compliance or enforcement activities. 9VAC25-610-140 C

3. The following is a summary of reporting requirements for specific facility wells:

Owner Well Name	DEQ Well #	Reporting Requirements
Well 1	163-00008	Water Use
Well 2	163-00097	Water Use

E. Water Conservation and Management Plan

1. The Water Conservation and Management Plan (WCMP) submitted in the application received [*date*] and subsequently amended and then approved by the Department is incorporated by reference into this permit and shall have the same effect as any condition contained in this permit and may be enforced as such.

2. By the end of the first year of the permit cycle [*date*] the Permittee shall submit documentation to the Department that the leak detection and repair program defined in the WCMP has been initiated. This documentation shall include activities completed during the first year of the permit term. 9VAC25-610-100 B

3. As soon as completed but not later than the end of the second year of the permit cycle [*date*] the Permittee shall submit to the Department results of an audit of the total amount of groundwater used in the distribution system and operational processes. This documentation shall include any resulting changes to the leak detection and repair program in the WCMP. 9VAC25-610-100 B

4. A report on the plan's effectiveness in reducing water use, including revisions to those elements of the WCMP that can be improved and addition of other elements found to be effective based on operations to date shall be submitted by the end of years five [*date*] and ten [*date*] of the permit term. These reports shall include as appropriate: 9VAC25-610-140 C

a. Any new water saving equipment installed or water saving processes adopted;

b. WCMP actions taken to reduce the volume of water needed to supply the system;

c. Planned short or long term efforts and actions to be added to the WCMP to improve the efficiency of water use in the system or by customers and for reducing the loss of water;

d. Results of additional water audits completed;

e. Review of water use category (residential, commercial, industrial) per-connection use in municipal systems;

f. Evaluation of the leak detection and repair program;

g. Description of educational activities completed; and

h. Identification of any water reuse opportunities identified.

5. If revisions or additions to the plan are necessary, an updated WCMP shall be submitted to the Department for approval along with the report prior to implementation of the revised plan.

6. Records of activities conducted pursuant to the WCMP are to be submitted to the Department upon request.

F. Well Tags

1. Each well that is included in this permit shall have affixed to the well casing, in a prominent place, a permanent well identification plate that records, at a minimum, the Department well identification number, the groundwater withdrawal permit number, the total depth of the well, and the screened intervals in the well. Such well identification plates shall be in a format specified by the Department and are available from the Department. 9VAC25-610-140 A 12

2. Well tags shall be affixed to the appropriate well casing within 30 days of receiving the tags from the Department. The accompanying well tag installation certification form shall be returned to the Department within 60 days of receipt of the tags. 9VAC25-610-140 C

Part II
Special Conditions

Pursuant to 9VAC25-610-140 B and C, the following Special Conditions apply to this permit in order to protect the public welfare, safety, and health or conserve, protect and help ensure the beneficial use of groundwater.

A. Geophysical Log Data Collection

Within 10 years of permit issuance, a complete suite of geophysical logs (Spontaneous Potential, Single Point Resistance, 16/64 Short and Long Normal, Natural Gamma at a scale of 20 ft per inch) shall be

obtained from at least one borehole at the location and depth approved by the Department during the coordination process. Given the unknown hydrogeology at the site and the known potential for significant horizontal variability, additional geophysical logs may be required as determined by the Department during the drilling work to assess the well field area. An electronic and hard copy of the geophysical logs shall be submitted to the Department within 30 days of collection to allow determination of the top and bottom of the aquifer in use. 9VAC25-610-140 C

At least three months prior to the scheduled geophysical logging, the Permittee shall notify the Department of the drilling timetable to receive any further guidance needed on performing the geophysical logging and to allow scheduling of Department staff to make a site visit during the drilling of the borehole and/or the geophysical logging. Geophysical log data collected without the oversight of the Department will not be accepted.

Part III
General Conditions

A. Duty to Comply

The Permittee shall comply with all conditions of the permit. Nothing in this permit shall be construed to relieve the permit holder of the duty to comply with all applicable federal and state statutes, regulations and prohibitions. Any permit violation is a violation of the law and is grounds for enforcement action, permit termination, revocation, modification, or denial of a permit application. 9VAC25-610-130 A

B. Duty to Cease or Confine Activity

It shall not be a defense for a Permittee in an enforcement action that it would have been necessary to halt or reduce the activity for which a permit has been granted in order to maintain compliance with the conditions of the permit. 9VAC25-610-130 B

C. Duty to Mitigate

The Permittee shall take all reasonable steps to avoid all adverse impacts that may result from this withdrawal as defined in 9VAC25-610-10 and provide mitigation of the adverse impact when necessary as described in 9VAC25-610-110 D 3 g and 9VAC25-610-130 C.

D. Inspection, Entry, and Information Requests

Upon presentation of credentials, the Permittee shall allow the Department, or any duly authorized agent of the Department, at reasonable times and under reasonable circumstances, to enter upon the Permittee's property, public or private, and have access to, inspect and copy any records that must be kept as part of the permit conditions, and to inspect any facilities, well(s), water supply system, operations, or practices (including sampling, monitoring and withdrawal) regulated or required under the permit. For the purpose of this section, the time for inspection shall be deemed reasonable during regular business hours. Nothing contained herein shall make an inspection time unreasonable during an emergency. 9VAC25-610-130 D

E. Duty to Provide Information

The Permittee shall furnish to the Department, within a reasonable time, any information that the Department may request to determine whether cause exists for modifying or revoking, reissuing, or terminating the permit, or to determine compliance with the permit. The Permittee shall also furnish to the Department, upon request, copies of records required to be kept by regulation or this permit. 9VAC25-610-130 E

F. Monitoring and Records Requirements

1. The Permittee shall maintain a copy of the permit on-site and/or shall make the permit available upon request. 9VAC25-610-130 E

2. Monitoring of parameters shall be conducted according to approved analytical methods as specified in the permit. 9VAC25-610-130 F 1

3. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity. 9VAC25-610-130 F 2

4. The Permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart or electronic recordings for continuous monitoring instrumentation, copies of all reports required by the permit, and records of all data used to complete the application for the permit, for a period of at least three years from the date of the expiration of a granted permit. This period may be extended by request of the Department at any time. 9VAC25-610-130 F 3

5. Records of monitoring information shall include as appropriate: 9VAC25-610-130 F 4

    a. the date, exact place and time of sampling or measurements;

    b. the name(s) of the individual(s) who performed the sampling or measurements;

    c. the date the analyses were performed;

    d. the name(s) of the individual(s) who performed the analyses;

    e. the analytical techniques or methods supporting the information, such as observations, readings, calculations and bench data used;

    f. the results of such analyses; and

    g. chain of custody documentation.

G. Environmental Laboratory Certification

The Permittee shall comply with the requirement for certification of laboratories conducting any tests, analyses, measurements, or monitoring required pursuant to the State Water Control Law (§ 62.1-44.2 et

seq. of the Code of Virginia), Environmental Laboratory Certification Program (§ 2.2-1105 et seq. of the Code of Virginia), Certification for Noncommercial Environmental Laboratories (1VAC30-45), and/or Accreditation for Commercial Environmental Laboratories (1VAC30-46), and

1. Ensure that all samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity.

2. Conduct monitoring according to procedures approved under 40CFR Part 136 or alternative methods approved by the U.S. Environmental Protection Agency.

3. Periodically calibrate and perform maintenance procedures on all monitoring and analytical instrumentation at intervals that will ensure accuracy of measurements. 1VAC30-45-20

H. Future Permitting Actions

1. A permit may be modified or revoked as set forth in Part VI of the Groundwater Withdrawal Regulations. 9VAC25-610-290 and 9VAC25-610-130 G

2. If a Permittee files a request for permit modification or revocation, or files a notification of planned changes, or anticipated noncompliance, the permit terms and conditions shall remain effective until the Department makes a final case decision. This provision shall not be used to extend the expiration date of the effective permit. 9VAC25-610-130 G

3. Permits may be modified or revoked upon the request of the Permittee, or upon Department initiative, to reflect the requirements of any changes in the statutes or regulations. 9VAC25-610-130 G

4. The Permittee shall schedule a meeting with the Department prior to submitting a new, expanded or modified permit application. 9VAC25-610-85

5. A new permit application shall be submitted 270 days prior to the expiration date of this permit, unless permission for a later date has been granted by the Department, to continue a withdrawal greater than or equal to 300,000 gallons in any month while an application for a renewal is being processed. 9VAC25-610-96

6. A new permit application shall be submitted 270 days prior to any proposed modification to this permit that will (i) result in an increase of withdrawal above permitted limits; or (ii) violate the terms and conditions of this permit. 9VAC25-610-96

7. The applicant shall provide all information described in 9VAC25-610-94 for any reapplication. 9VAC25-610-96 C

8. The Permittee must notify the Department in writing of any changes to owner and facility contact information within 30 days of the change. 9VAC25-610-140 C

I. Metering and Equipment Requirements

1. Each well and/or impoundment or impoundment system shall have an in-line totalizing flow meter to

read gallons, cubic feet, or cubic meters installed prior to beginning the permitted use. Meters shall produce volume determinations within plus or minus 10% of actual flows. An alternative method for determining flow may be approved by the Department on a case-by-case basis. 9VAC25-610-140 A 7 b

a. A defective meter or other device must be repaired or replaced within 30 days.

b. A defective meter is not grounds for not reporting withdrawals. During any period when a meter is defective, generally accepted engineering methods shall be used to estimate withdrawals. The period during which the meter was defective must be clearly identified in the groundwater withdrawal report required by Part I, Subsection D of this permit.

2. Each well shall be equipped in a manner such that water levels can be measured during pumping and non-pumping periods without dismantling any equipment. Any opening for tape measurement of water levels shall have an inside diameter of at least 0.5 inches and be sealed by a removable plug or cap. The Permittee shall provide a tap for taking raw water samples from each permitted well. 9VAC25-610-140 A 7 e

J. Minor Modifications

1. A minor modification to this permit must be made to replace an existing well(s) or add an additional well(s) provided that the well(s) is screened in the same aquifer(s) as the existing well(s), and is in the near vicinity of the existing well(s), the total groundwater withdrawal does not increase, the area of impact does not increase, and the well has been approved by the Department prior to construction. 9VAC25-610-330 B 4 and B 5

2. A minor modification to this permit must be made to combine withdrawals governed by multiple permits when the systems are physically connected as long as interconnection will not result in additional groundwater withdrawal and the area of impact will not increase. 9VAC25-610-330 B 6

3. Minor modifications to this permit must also be made to:

a. Change an interim compliance date up to 120 days from the original compliance date, as long as the change does not interfere with the final compliance date. 9VAC25-610-330 B 7

b. Allow for change in ownership when the Department determines no other change in the permit is necessary and the appropriate written agreements are provided in accordance with the transferability of permits and special exceptions. 9VAC25-610-320 and 9VAC25-610-330 B 8

c. Revise a Water Conservation and Management Plan to update conservation measures being implemented by the Permittee that increase the amount of groundwater conserved. 9VAC25-610-330 B 9

K. Well Construction

At least two weeks prior to the scheduled construction of any well(s), the Permittee shall notify the Department of the construction timetable and receive prior approval of the well(s) location(s) and

acquire the Department Well number (DEQ Well #). All wells shall be constructed in accordance with the following requirements.

1. A well site approval letter or well construction permit must be obtained from the Virginia Department of Health prior to construction of the well. 9VAC25-610-130 A

2. A complete suite of geophysical logs (16"/64" Normal, Single Point, Self-Potential, Lateral, and Natural Gamma) shall be completed for the well and submitted to the Department along with the corresponding completion report. 9VAC25-610-140 C

3. The Permittee shall evaluate the geophysical log and driller's log information to estimate the top of the target aquifer and; therefore, a depth below which the pump shall not be set. The Permittee's determination of the top of the target aquifer shall be submitted to the Department for review and approval, or approved on site by the Department's Groundwater Characterization staff, prior to installation of any pump. 9VAC25-610-140 A 6

4. The Permittee shall install gravel packs and grout in a manner that prevents leakance between aquifers. Gravel pack shall be terminated close to the top of the well screen(s) and shall not extend above the top of the target aquifer. 9VAC25-610-140 C

5. A completed GW-2 Form and any additional water well construction documents shall be submitted to the Department within 30 days of the completion of any well and prior to the initiation of any withdrawal from the well. The assigned Department Well number shall be included on all well documents. 9VAC25-610-140 C

6. In addition to the above requirements, if required by the permit, construction of a Water Level Monitoring State Observation Well (SOW) requires:

    a. The Permittee shall coordinate activities with the Department's Groundwater Characterization Program (GWCP) to determine the appropriate observation well location and construction schedule, along with the needed screen interval(s), and other completion details following review of geophysical logging. 9VAC25-610-140 C

    b. Prior to preparation of bid documents for construction of the observation well, the Permittee shall notify the Department and shall include any GWCP requirements in the bid documents. At a minimum, the Department will require a pre-bid meeting with interested drilling contractors and a pre-construction meeting with the successful bidder. 9VAC25-610-140 C

    c. Instrumentation to meet the requirements for real-time data transmission consistent with the State Observation Well Network shall be purchased by the Permittee. The Permittee shall submit a purchase order based on the Department's equipment specifications for review and approval prior to purchase of the equipment. The Permittee shall install the real-time equipment infrastructure with Department oversight. The Department will conduct the installation of the transducer and final hook-up of the equipment. 9VAC25-610-140 C

7. In addition to the above requirements, if required by the permit, construction of a Chloride Monitoring SOW requires:

a. The Permittee shall coordinate activities with the Department's Groundwater Characterization Program (GWCP) to determine the appropriate observation well location and construction schedule, along with the needed screen interval(s), and other completion details following review of geophysical logging. 9VAC25-610-140 C

b. Prior to preparation of bid documents for construction of the observation well, the Permittee shall notify the Department and shall include any GWCP requirements in the bid documents. At a minimum, the Department will require a pre-bid meeting with interested drilling contractors and a pre-construction meeting with the successful bidder. 9VAC25-610-140 C

c. Instrumentation to meet the requirements for real-time data transmission consistent with the State Observation Well Network shall be purchased by the Permittee. The Permittee shall submit a purchase order based on the Department's equipment specifications for review and approval prior to purchase of the equipment. The Permittee shall install the real-time equipment infrastructure with Department oversight. The Department will conduct final hook-up of the equipment. 9VAC25-610-140 C

d. Instrumentation to meet the requirements for continuous measurement of specific conductance from multiple levels within the well screen shall be purchased by the Permittee. The Permittee shall submit a purchase order based on the Department's equipment specifications for review and approval prior to purchase of the equipment. The Permittee shall install the real-time equipment infrastructure with Department oversight. The Department will conduct the final hook-up of the equipment. 9VAC25-610-140 C

L. Permit Reopening

This permit may be reopened for the purpose of modifying the conditions of the permit as follows:

1. To meet new regulatory standards duly adopted by the Board. 9VAC25-610-140 A 11

2. When new information becomes available about the permitted withdrawal, or the impact of the withdrawal, which had not been available at permit issuance and would have justified the application of different conditions at the time of issuance. 9VAC25-610-310 B 1

3. When the reported withdrawal is less than 60% of the permitted withdrawal amount for a five year period. 9VAC25-610-310 B 2

4. If monitoring information indicates the potential for adverse impacts to groundwater quality or level due to this withdrawal. 9VAC25-610-140 C

COMMONWEALTH of VIRGINIA
DEPARTMENT OF ENVIRONMENTAL QUALITY

PERMIT ISSUANCE FACT SHEET

Groundwater Withdrawal Permit Number: GW0009801
Application Date: October 29, 2021

The Department of Environmental Quality (Department or DEQ) has reviewed the application for a Groundwater Withdrawal Permit. This document provides the pertinent information concerning the legal basis, scientific rationale and justification for the issuance/reissuance/modification of the Groundwater Withdrawal Permit listed below. Based on the information provided in the application and subsequent revisions, DEQ has determined that there is a reasonable assurance that the activity authorized by the permit is a beneficial use as defined by the regulations. Groundwater impacts have been minimized to the maximum extent practicable. The following details the application review process and summarizes relevant information for developing the Permit and applicable conditions.

Permittee / Legal Responsible Party

Name & Address:	Aqua Virginia, Inc. 2414 Granite Ridge Road Rockville, Virginia 23146
Phone:	(804) 432-3407

Facility Name and Address

Name & Address:	Brookwood Manor Public Water System 7849 Woodbrook Road Quinton, Virginia 23141
Phone:	(804) 749-8868 x54425

Contact Information:

Name:	Joshua Harris
E-mail:	JGHarris@aquaamerica.com
Phone:	(804) 749-8868 x54418

Proposed Beneficial Use:
For the operation of a privately owned public water system for the Brookwood Manor subdivision.

Staff Findings and Recommendations

Based on review of the permit application, staff provides the following findings.

- The proposed activity is consistent with the provisions of the Ground Water Management Act of 1992, and will protect other beneficial uses.
- The proposed permit addresses minimization of the amount of groundwater needed to provide the intended beneficial use.
- The effect of the impact will not cause or contribute to significant impairment of state waters.
- The permit reflects the required consultation with and full consideration of the written recommendations of the Virginia Department of Health (VDH).

Staff recommends Groundwater Withdrawal Permit Number GW0009801 be issued as proposed.

Approved: _____
Scott Morris, DBA, P.E.
Director, Water Division

Date: _____

Processing Dates

Processing Action	Date Occurred/Received
Pre-Application Meeting:	May 18, 2020
Application Received by DEQ:	October 29, 2021
Permit Fee Deposited by Accounting:	October 14, 2021
Application Review Conducted:	March 15, 2023
Local Government Ordinance Form Received by DEQ:	October 29, 2021
Application Complete:	March 15, 2023
Submit Request for Technical Evaluation:	March 15, 2023
Technical Evaluation Received by DEQ:	March 30, 2023
Draft Permit Package Sent:	April 27, 2023
Public Notice Published:	May 17, 2023
End of 30-Day Public Comment Period:	June 16, 2023
Response to Public comment:	
Public Meeting or Hearing:	

Application

Application Information

Description:

Background / Purpose of Facility
The Brookwood Manor system is in western New Kent County and was issued Groundwater Withdrawal Permit number GW0009800 on August 1, 2012 to withdraw a maximum of 5,335,000 gallons per year (gal/yr) and 778,000 gallons per month (gal/mo). This permit expired July 31, 2022 and was administratively continued pursuant to 9VAC25-610-96.

The system provides potable water to residents of the Brookwood Manor subdivision and one (1) commercial entity. The subdivision has a total of 76 lots, with all 76 lots currently constructed and connected to the system. No additional future connections are expected over the next 15-year GWWP term.

Location of Facility/Withdrawal:

Water Supply Planning Unit: New Kent County

County: New Kent

GWMA/Aquifer: Eastern Virginia GWMA/Potomac aquifer

Conjunctive Use Source: No conjunctive use.

Withdrawal Use, Current Need, and Projected Demand:

Basis of Need:
The system provides potable water to residents of the Brookwood Manor subdivision and one (1) commercial entity. The subdivision has a total of 76 lots, with all 76 lots currently constructed and connected to the system. No additional future connections are expected over the next 15-year GWWP term. The subdivision primarily uses groundwater for drinking, bathing, cooking, dishwashing, sanitation (toilets and lavatories), cleaning, and laundry. A small amount of water is used for non-essential purposes such as vehicle washing, lawn and landscape irrigation, and filling of swimming pools. Some groundwater from the system is periodically used for line flushing (maintenance).

Water Demand and Projections:
There are currently 76 active connections to the water system. The maximum groundwater production over a consecutive 12-month period during the last ten years (2011-2020) was 4,823,030 gallons (August 2012 – July 2013), which equates to 174 gal/day/c. Rounded up to the nearest 100,000 gallons, the requested annual withdrawal amount for the Brookwood Manor system is 4,900,000 gallons per year (gpy).

The requested monthly withdrawal amount is based on the maximum historic monthly production from 2016 through 2020, which reached a maximum of 12.3% of the total annual production. Rounded up to the nearest 100,000 gallons, the requested monthly withdrawal amount for the Brookwood Manor system is 700,000 gallons per month.

Withdrawal Volumes Requested: The applicant requested the following withdrawal volumes based upon the projected groundwater demand.

Period of Withdrawal (15-Year)	Total Volume (gal.)	Volume in gal/day
Maximum Monthly:	700,000	22,581
Maximum Annual:	4,900,000	13,425

Department Evaluation

Historic Withdrawals:
The average annual groundwater production during the last five years 2016 through 2020 was 3,923,838 gal/yr, which equates to approximately 140 gallons per day (gal/day) per connection (gal/day/c). Water demand at the Brookwood Manor subdivision is moderately seasonal due to normal increased summertime water usage both for essential and non-essential purposes (e.g., landscape irrigation). All of the system's connections are year-round occupancy, and the vast majority are single-family homes. During the last five years (2016-2020), the months of June, July, August, and September on average account for approximately 35% of the annual usage and reached a maximum of approximately 36% of annual usage in 2020. Peak monthly usage, normally in June, July, or August, is on average approximately 9% of the year's total production, and in June 2018 reached approximately 12% of the total annual production.

Analysis of Alternative Water Supplies:

The only nearby public water system of sufficient capacity to meet the demands of the Brookwood Manor System is the New Kent County public water system and the Five Lakes system operated by Aqua Virginia, Inc. Both systems withdraw water from the Potomac aquifer and do not present a net benefit to the aquifer by interconnecting.

The nearest surface water bodies are small ponds (<0.5 acre) within 1.5 miles of the service area and an unnamed stream within the service area. These surface water bodies' capacities are small relative to the demands of the system. Additional water quality would require extensive treatment before it could be used as a potable water source.

In the Brookwood Manor area, four aquifers are present, as indicated by the most recent update to the Virginia Coastal Plain Hydrogeologic Framework provided by Aquaveo in January 2020. The Surficial aquifer is the shallowest, unconfined (water table) aquifer that exists directly beneath the surface. The thickness and hydraulic properties of this unit vary widely over relatively small areas, and wells in the Surficial aquifer located near surface water bodies are subject to induced infiltration of surface water. Occurring directly beneath the surface without an overlying confining unit, this aquifer is vulnerable to contamination from agricultural, urban, and other sources such as leaking underground petroleum tanks. As such, the Surficial aquifer is generally not used as a source of potable water. Underlying the Surficial aquifer in order of youngest (shallowest) to oldest (deepest) are the confined Piney Point aquifer, Aquia aquifer, and the Potomac aquifer. The Piney Point and Aquia aquifers are generally too thin in this area to provide large quantities of potable water for a community water system. The Potomac aquifer is the thickest and most widely-used source of groundwater in the area as well as in the Virginia Coastal Plain. The Potomac aquifer is capable of providing large quantities of potable-quality water for municipalities, non-municipal community water systems, agriculture, and industry. Based on the most recent update to the Virginia Coastal Plain Hydrogeologic Framework, the Potomac aquifer is approximately 12 to 15 times thicker than the overlying Aquia and Piney Point aquifers and as such transmits and stores more groundwater than the overlying units. Additionally, the Potomac aquifer exhibits high permeability due to its coarse sand and gravel content, which increases its ability to transmit groundwater to wells. Wells in the Potomac aquifer, therefore, are common sources of water for community, municipal, and industrial uses. In contrast, wells constructed in the Surficial, Piney Point, and Aquia aquifers are normally only sufficient for individual residential and landscape irrigation uses or small community water systems. Given the water quality and quantity considerations outlined above, the Potomac aquifer is the only viable source of water for the Brookwood Manor water system.

Public Water Supply:
A Class VI community waterworks, having a design capacity of 39,200 gal/day at Brookwood Manor was issued a Waterworks Operation Permit (No. 4127055) dated March 29, 1978.

Water Supply Plan Review:
Brookwood Manor is included in the New Kent County Water Supply Plan (2010). Water Supply Plan demand projections for the facility were included in the Plan and could be considered in the evaluation of the permit request. The Water Supply Plan states that existing sources for the facility were projected to meet demands through 2060.

Department Recommended Withdrawal Limits:

Department staff reviewed the water demand and projections provided by Aqua Virginia, Inc. and finds that the water demand justifications for the annual and monthly withdrawals limits were justified to meet the beneficial use need identified for a public water supply.

The Department recommends the following withdrawal volumes based upon evaluation of the groundwater withdrawal permit application.

Period of Withdrawal (15-Year)	Total Volume (gal.)	Volume in gal/day
Maximum Monthly:	700,000	22,581
Maximum Annual:	4,900,000	13,425

Technical Evaluation:
Aquaveo, LLC performed a technical evaluation of the application for the Department based on the VAHydro Groundwater Coastal Plain Model (VAHydroGW-VCPM). The objective of this evaluation was to determine the areas of any aquifer that will experience at least one foot of water level decline due to the proposed withdrawal (the Area of Impact or AOI), to determine the potential for the proposed withdrawal to cause salt-water intrusion, and to determine if the proposed withdrawal meets the 80% drawdown criteria. Aquaveo, LLC also evaluated water levels in the VAHydroGW-VCPM compared to measured field values.

The Department concluded that the proposed withdrawal satisfies the technical evaluation criteria for permit issuance. A summary of the results of the evaluation and the AOI for the Potomac aquifer is provided in the Technical Evaluation (Attachment 1).

Part I
Operating Conditions

Authorized Withdrawals:

Owner Well Name	DEQ Well #	Aquifer	Type	Pump Intake Limit (ft. bls)
Well #1	163-00008	Potomac	Production	263*
Well #2	163-00097	Potomac	Production	270*

*The pump intake limits were interpolated from the aquifer depth values from the VAHydroGW-VCPM Model in the Technical Evaluation.

Apportionment:
Both production wells are located in the same cell of the VaHydroGW-VCPM Model and screened in the Potomac aquifer. Therefore, apportionment limits are not needed.

Additional Wells:

Observation Wells: There are no observation wells.

Abandoned Wells: There are no abandoned wells.

Out of Service Wells: There are no out of service wells.

Pump Intake Settings:
All well pumps are correctly positioned in accordance with 9VAC25-610-140 A 6.

Withdrawal Reporting:
Groundwater withdrawals are to be recorded monthly and reported quarterly.

Water Conservation and Management Plan:
A Water Conservation and Management Plan (WCMP) meeting the requirements of 9VAC25-610-100.B was submitted and reviewed as part of the application process. The accepted Plan is to be followed by the permittee as an operational Plan for the facility/water system, is incorporated by reference into this permit, and shall have the same effect as any condition contained in this permit and may be enforced as such (Attachment 2). In addition, the Permit includes conditions requiring the following:

- Documentation that the leak detection and repair program defined in the WCMP has been initiated is due by the end of the first year of the permit term.
- A result of an audit of the total amount of groundwater used in the distribution system and operational processes is due by the end of the second year of the permit term.
- A report on the plan's effectiveness in reducing water use, including revisions to those elements of the WCMP that can be improved and addition of other elements found to be effective based on operations to date shall be submitted by the end of years five [*date*] and ten [*date*] of the permit term.

Mitigation Plan:
The predicted AOI resulting from the Technical Evaluation could not be defined in the Potomac aquifer because the maximum drawdown estimated from the simulation was less than one foot at the wellbore. A Mitigation Plan was therefore not required for the permit.

Well Tags:
Well tags will be transmitted with the final permit.

Part II
Special Conditions

With the exception of conditions listed below, review of the applicant's application well construction data, operations at the facility, and the Technical Evaluation of the application did not identify a need for water quality or water level monitoring, pump intake reset, or well abandonment conditions in the permit. There are no new wells currently planned for construction during the permit term.

Geophysical Borehole:

Within 10 years of permit issuance, a complete suite of geophysical logs (Spontaneous Potential, Single Point Resistance, 16/64 Short and Long Normal, Natural Gamma at a scale of 20 ft per inch) shall be obtained from at least one borehole at the location and depth approved by the Department during the coordination process. Given the unknown hydrogeology at the site and the known potential for significant horizontal variability, additional geophysical logs may be required as determined by the Department during the drilling work to assess the well field area. An

electronic and hard copy of the geophysical logs shall be submitted to the Department within 30 days of collection to allow determination of the top and bottom of the aquifer in use. 9VAC25-610-140 C

At least three months prior to the scheduled geophysical logging, the Permittee shall notify the Department of the drilling timetable to receive any further guidance needed on performing the geophysical logging and to allow scheduling of Department staff to make a site visit during the drilling of the borehole and/or the geophysical logging. Geophysical log data collected without the oversight of the Department will not be accepted.

Part III
General Conditions

General Conditions are applied to all Groundwater Withdrawal Permits, as stated in the Groundwater Withdrawal Regulations, 9VAC25-610.

Public Comment

The following sections will be completed after close of the public comment period.

Relevant Regulatory Agency Comments:

Summary of VDH Comments and Actions: VDH stated in their response to the Draft Permit Package that the requirements of the draft permit were not more restrictive than the historical monthly or annual withdrawal for the past 12 months. It was also stated that if the final permit remains consistent with the draft permit, then no further action is necessary by the waterworks owner.

Public Involvement during Application Process:

Local and Area wide Planning Requirements: The New Kent County Administrator certified on January 31, 2020, that the facility's operations are consistent with all ordinances. The Department received this certification on October 29, 2021.

Public Comment/Meetings:
The public notice was published in *The Tidewater Review* on May 17, 2023. The public comment period ran from May 17, 2023 to June 16, 2023.

Changes in Permit Part II Due to Public Comments

Changes in Permit Part III Due to Public Comments

Attachments

1. **Technical Evaluation**
2. **Water Conservation and Management Plan**
3. **Public Comment Sheet**

COMMONWEALTH of VIRGINIA
DEPARTMENT OF ENVIRONMENTAL QUALITY

TECHNICAL EVALUATION FOR PROPOSED GROUNDWATER WITHDRAWAL

Date: March 15, 2023

Application /Permit Number: GW0009801

Owner / Applicant Name: Aqua Virginia, Inc.

Facility / System Name: Brookwood Manor Public Water System

Facility Type: Public water supply with one commercial connection

Facility / System Location: New Kent County

The Commonwealth of Virginia's Groundwater Withdrawal Regulations (9VAC25-610) provide that, for a permit to be issued for a new withdrawal, to expand an existing withdrawal, or reapply for a current withdrawal, a technical evaluation shall be conducted. This report documents the results of the technical evaluation conducted to meet the requirements for the issuance of a permit to withdraw groundwater within a Designated Groundwater Management Area (9VAC25-600).

This evaluation determines the:

(1) The Area of Impact (AOI): The AOI for an aquifer is the areal extent of each aquifer where one foot or more of drawdown is predicted to occur as a result of the proposed withdrawal.

(2) Water Quality: The potential for the proposed withdrawal to cause salt water intrusion into any portion of any aquifers or the movement of waters of lower quality into areas where such movement would result in adverse impacts on existing groundwater users or the groundwater resource.

(3) The Eighty Percent Drawdown (80% Drawdown): The proposed withdrawal in combination with all existing lawful withdrawals will not lower water levels, in any confined aquifer that the withdrawal impacts, below a point that represents 80% of the distance between the land surface and the top of the aquifer at the points where the one-foot drawdown contour is predicted for the proposed withdrawal.

Requested withdrawal amount:

Requested Withdrawal Amount	
Fifteen (15) Year Value	N/A
Annual Value	4,900,000 gal (13,425 average gpd)
Monthly Value	700,000 gal (22,581 average gpd)

Requested Apportionment of Withdrawal:

DEQ Well #	**Owner Well #**	**Aquifer**	**Percent of Withdrawal**
163-00008	1	Potomac	20%
163-00097	2	Potomac	80%

Summary of Requested Withdrawal:
The application is for 4,900,000 gallons per year to support an existing withdrawal. The Brookwood Manor subdivision serves 75 residential connections and one day care facility, utilizing two active wells. The water system has been in operation since 1974 and includes a total of 76 residential lots and 1 commercial entity. Development of the subdivision began in 1968 with peak new construction occurring in the late 1970's. Operation of the system appears to have varied little since completion of the main subdivision build out. Some summer irrigation occurs within the development and several swimming pools are also present.

Production Well(s):

Identification	Location	Construction	Pump Intake	Source Aquifer
Owner Well Name: Well #1 DEQ Well Number: 163-00008 MPID: 373107077104901	Lat: : 37° 31' 9.9" Lon: 77° 10' 44.2" Datum: NAD27 Elevation: 115 ft	Completion Date: 10/22/1965 Screens (ft/bls): 285-305 Total Depth (ft/bls): 305	220 ft bls	Potomac
Owner Well Name: Well #2 DEQ Well Number: 163-00097 MPID: 373107077104902	Lat: : 37° 30' 59.5" Lon: 77° 10' 49.7" Datum: NAD27 Elevation: 122 ft	Completion Date: 09/23/0977 Screens (ft/bls): 294-314 Total Depth (ft/bls): 345	240 ft bls	Potomac

Out of Service Wells:
There are no out of service wells associated with this system.

Well(s) to be Abandoned:
There are no wells to be abandoned associated with this system.

Observation Wells:
There are no observation wells associated with this system.

Geologic Setting:
The Brookwood Manor Public Water System wells (applicant wells) are located in New Kent County. The applicant's production wells are screened in the Potomac aquifer. USGS Professional Paper 1731[1], *The Virginia Coastal Plain Hydrogeologic Framework* (VCPHF), is the most recent study discussing the aquifers and confining units of the Virginia Coastal Plain. The study utilized numerous boreholes throughout the Virginia Coastal Plain to interpolate the elevations of the different hydrogeologic units found in the Coastal Plain.

According to the study, the Potomac aquifer is the "largest, deepest, and most heavily used source of ground water in the Virginia Coastal Plain." The aquifer is underlain across its entire extent with basement bedrock. The aquifer is found below the Potomac confining zone. The aquifer is primarily composed "of fluvial-deltaic coarse-grained quartz and feldspar sands and gravels and interbedded clays."

[1] McFarland E. R., and Bruce T.S., 2006. The Virginia Coastal Plain Hydrologic Framework: U.S. Geologic Survey Professional Paper 1731. 118 p., 25 pls. (available online at http://pubs.water.usgs.gov/pp1731/).

The nearest east-west geologic cross section, DD-DD', from the USGS Professional Paper 1731 is shown in the figure at the end of this report.

Hydrologic Framework:
Data from the VCPHF is reported in this technical report to illustrate the hydrogeologic characteristics of the aquifers in the Virginia Coastal Plain near the applicant well and identify major discrepancies between regional hydrogeology and site logs interpreted by the DEQ staff geologist. The Virginia Coastal Plain Model[2] (VCPM) framework was constructed by extracting the hydrogeologic unit tops and thicknesses from the VCPHF. The original USGS VCPM was updated and adapted for use in the VA-DEQ well permitting process and is referred to as VAHydroGW-VCPM.

VAHydroGW-VCPM Model:
The following table lists the locations of the applicant production wells within the VAHydroGW-VCPM Model.

VAHydroGW-VCPM Model Grid				
Well	**Well Number**	**MPID**	**Row**	**Column**
Well #1	163-00008	373107077104901	62	20
Well #2	163-00097	373107077104902	62	20

The following aquifer top elevations and thicknesses are simulated in the VAHydroGW-VCPM Model at the model cell containing the applicant wells.

VAHydroGW-VCPM Model Hydrogeologic Unit Information		
Aquifer	**Elevation (ft-msl)**	**Depth (ft-bls)**
Surface	130	0
Water Table aquifer (bottom)	83	47
Piney Point (top)	36	94
Piney Point (bottom)	3	127
Aquia (top)	-72	202
Aquia (bottom)	-118	248
Potomac (top)	-148	278
Potomac (bottom)	-639	769

Note: ft-msl = feet mean sea level

Groundwater Characterization Program Recommendations:
The Department requests the aquifer top identification be determined by the Virginia Coastal Plain Model.

Comparison of the Hydrogeologic Framework and Geologist Report:
The VCPMF identifies the average top and thickness of the Potomac aquifer at an elevation of 278 ft-bls and 491 feet thick at the cell containing the applicant wells, respectively. The average top elevation and thickness of the Potomac aquifer were not provided by DEQ staff so a comparison could not be made for this analysis.

[2] Heywood, C.E., and Pope, J.P., 2009, Simulation of groundwater flow in the Coastal Plain aquifer system of Virginia: U.S. Geological Survey Scientific Investigations Report 2009–5039, 115 p.

Pump Intake Elevation:
Virginia regulations specify that well pump intakes must be placed at or above the top of the source aquifer.[3] The top elevation for the production wells were not provided by DEQ staff so an assessment of the compliance with the limits specified by regulation[4] could not be made as part of this analysis.

Water Level Comparison:
The *Virginia Coastal Plain Model (VAHydroGW-VCPM) 2021-2022 Annual Simulation of Potentiometric Groundwater Surface Elevations of Reported and Total Permitted Use* report (the *2021-2022 report)* and modeling files[5] provide two sets of simulated potentiometric water surface elevations. These water elevations are based upon, 1) the reported withdrawal amount of wells in the VAHydroGW-VCPM model ("the reported use simulation") and, 2) the total permitted withdrawal amount for wells in the VAHydroGW-VCPM model ("the total permitted simulation"). USGS regional observation network well water levels were compared to the water levels in the 2021-2022 report in order to evaluate the performance of the regional model in the vicinity of the applicant wells and assess historical groundwater trends. In the tables below, simulated water levels from the year 2021, from the reported use simulation, were compared to USGS measured water levels for the same year. For comparison, the total permitted simulated water levels are also reported. The total permitted water levels are taken from the end of the 50 year total permitted simulation and represent simulated water levels, 50 years from present, if all GWMA wells were to pump at their total permitted amount.

The USGS regional observation network wells closest to the applicant wells are shown in Figure 1 and listed in the following tables. The depth of these wells correspond with the Potomac aquifer. The distances from the applicant wells to the USGS wells are also given in the tables. The VAHydroGW-VCPM row and column containing the USGS wells are also given. The water levels obtained from the regional observation network wells are shown in Figures 2 and 3**.** These figures also show the water levels from the reported use VAHydroGW-VCPM simulation for the cell containing each USGS well.

The water level graph for the first well in the Potomac aquifer (53J 6) shows a steady decline in water levels from the time of the earliest available records (1965) to about 1996. Water levels from 1996 to the present show the water levels stabilizing. The water level graph for the second well in the Potomac aquifer (53J 25 SOW 234B) shows relatively small changes in the time period for which USGS water level data is available for comparison. The 2021 annual average water levels observed in the regional observation network wells are given in the following tables (when available).

The USGS observed water levels are generally in agreement with the VAHydroGW-VCPM simulated reported use water levels. The simulated water levels at USGS well 53J 6 are within a few feet of the model simulated water levels over the last several years. The model simulated heads at USGS wells 53J 25 SOW 234B are about 2 to 7 feet higher than the USGS measured water levels.

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[3] 9 VAC 25 610 140.A.5. "The permittee shall not place a pump or water intake device lower than the top of the uppermost confined aquifer that a well utilizes as a ground water source or lower than the bottom of an unconfined aquifer that a well utilizes as a ground water source;

[4] 9 VAC 25 610 140.A.5. "The permittee shall not place a pump or water intake device lower than the top of the uppermost confined aquifer that a well utilizes as a ground water source or lower than the bottom of an unconfined aquifer that a well utilizes as a ground water source;

[5] Refer to "Virginia Coastal Plain Model (VAHydroGW-VCPM) 2021-2022 Annual Simulation of Potentiometric Groundwater Surface Elevations of Reported and Total Permitted Use" at http://www.deq.virginia.gov/Programs/Water/WaterSupplyWaterQuantity/GroundwaterCharacterization/ReportsPublications.aspx

Potomac Aquifer		
Measurement	**Well 53J 6**	**Well 53J 25 SOW 234B**
Distance from nearest applicant well (miles)	0.03	3.1
Elevation (ft-msl)	115	172
VAHydroGW-VCPM Row	62	59
VAHydroGW-VCPM Column	20	18
VAHydroGW-VCPM Cell Elevation	130	180
USGS Regional Well 2021 Average Water Level (ft-bls)	*	210.5
USGS Regional Well 2021 Average Water Level (ft-msl)	*	-38.5
VAHydroGW-VCPM 2021 Reported Use Simulated Water Level (ft-bls)	170.9	214.3
VAHydroGW-VCPM 2021 Reported Use Simulated Water Level (ft-msl)	-40.9	-34.3
VAHydroGW-VCPM Total Permitted Simulated Water Level (ft-bls)	179.7	220.6
VAHydroGW-VCPM Total Permitted Simulated Water Level (ft-msl)	-49.7	-40.6

**Data not available*

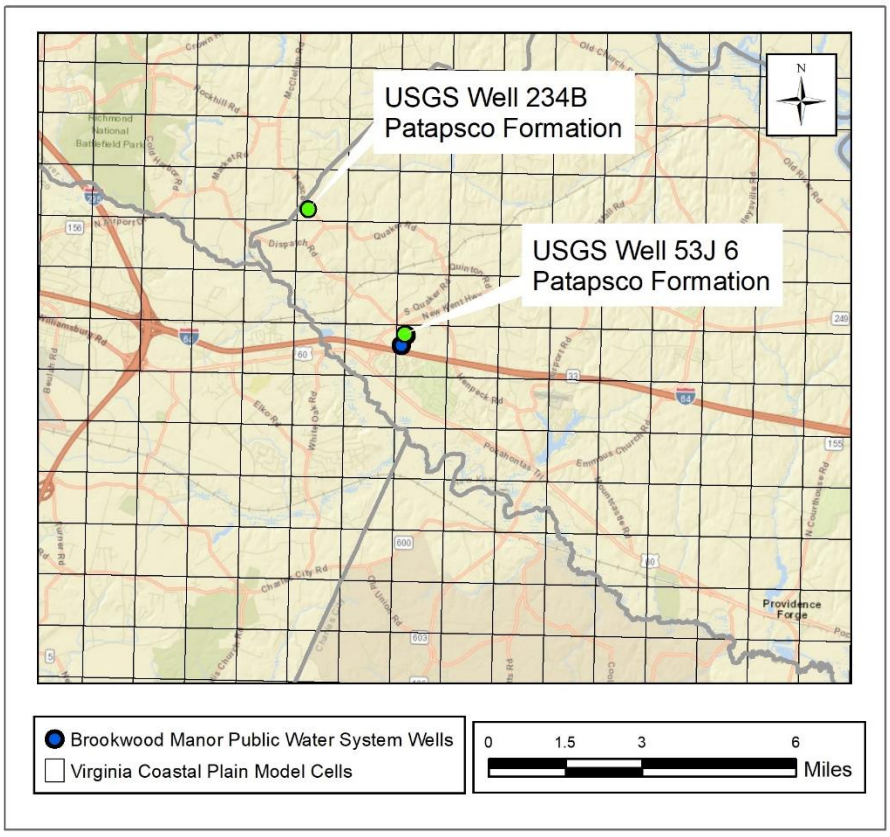


Figure 1. Nearest USGS regional observation network wells.

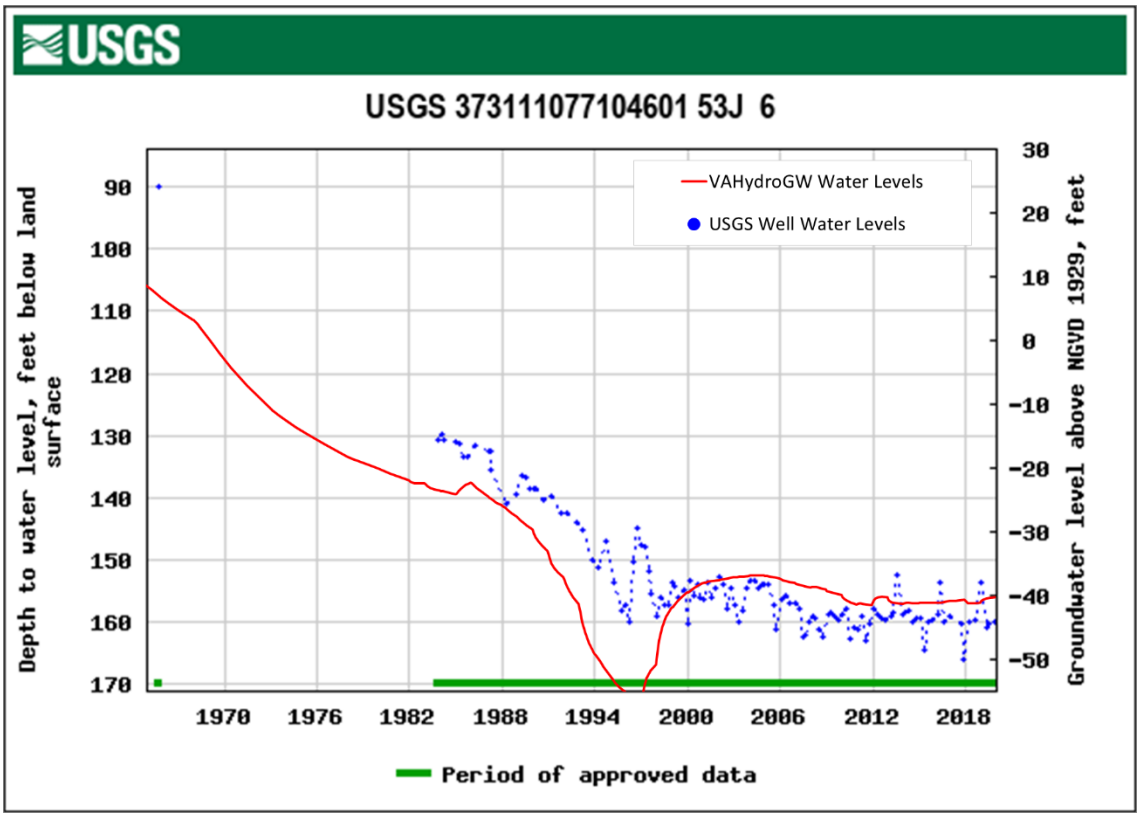


Figure 2. USGS Regional Observation Well 53J 6, Potomac aquifer water levels (Patapsco Formation) recorded from 1965 to 2019 (well depth 305 ft bls, land surface 115 ft msl) and VAHydroGW-VCPM reported use water levels.

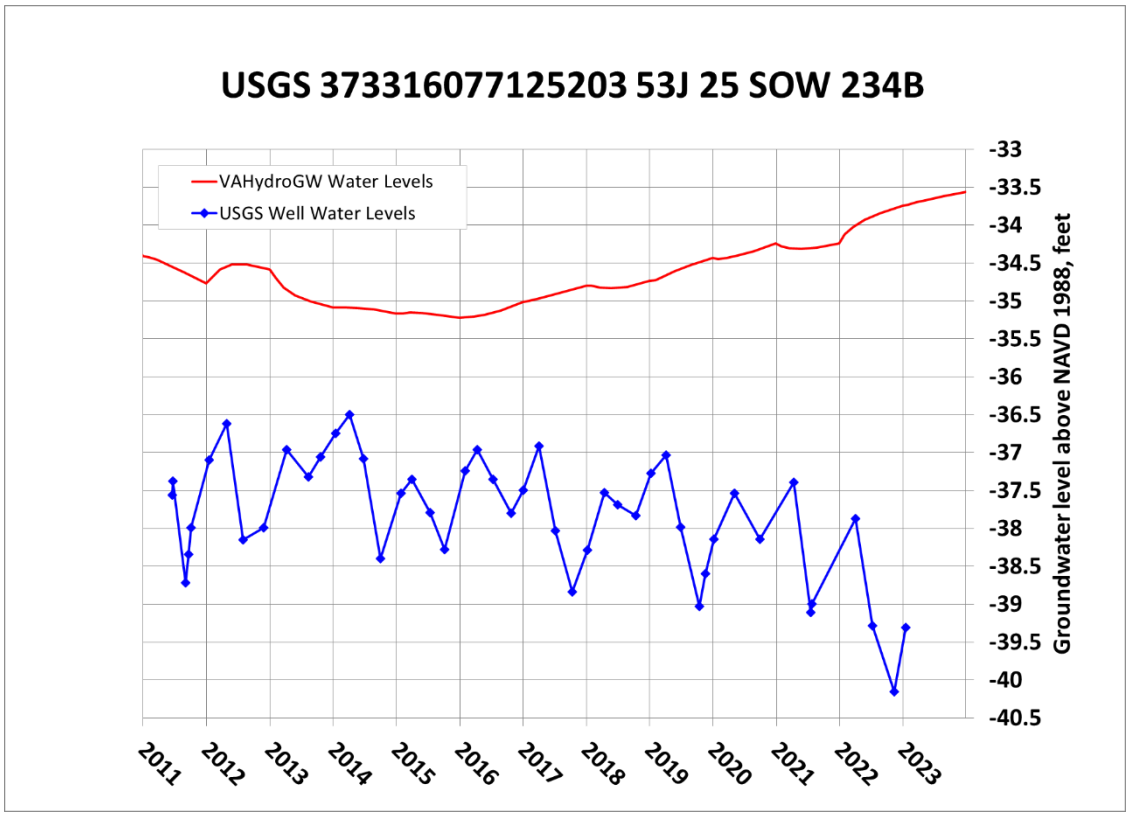


Figure 3. USGS Regional Observation Well 53J 25 SOW 234B, Potomac aquifer water levels (Patapsco Formation) recorded from 2011 to present (well depth 330 ft bls, land surface 172 ft msl) and VAHydroGW-VCPM reported use water levels.

Aquifer Test(s):
No aquifer test(s) were conducted at the facility.

The hydraulic properties for the VAHydroGW-VCPM cell containing the applicant wells are shown in the following table.

Hydrogeologic Unit	Horizontal Conductivity (ft/day)	Transmissivity (ft^2/day)	Storage Coefficient	Specific Storage (1/ft)
Surficial (Columbia) aquifer	2	94	-	0.000032
Piney Point aquifer	18.8	618.8	0.00106	0.000032
Aquia aquifer	109	5,014	0.00148	0.000032
Potomac aquifer	8.7	4,253.9	0.00091	0.000002

Model Results

Evaluation of Withdrawal Impacts:
The magnitude of the proposed withdrawal does not allow for assessment of the area of impact using VAHydroGW-VCPM. The aquifer parameters from the analysis of the nearby aquifer testing described in the technical evaluation from 2011 for Five Lakes Public Water Supply facility were used to perform a two-dimensional analytical simulation to simulate drawdown due to the requested withdrawal for this technical evaluation. The drawdown in the Potomac aquifer resulting from the proposed withdrawal was calculated using Theis (1935) 2-D analytical simulations. The Theis simulation predicts the drawdown in a confined aquifer assuming constant discharge from a fully penetrating well. The following parameters were used for the 2-D analytical simulation:

Model Input Parameters (source: 2011 Five Lakes #1 Public Water Supply GW0008600 Technical Evaluation):
Potomac Transmissivity = 3,762 ft^2/day
Potomac Storage Coefficient = 6.54×10^{-4}

Withdrawal rate/Simulation Time = 50 years at 4,900,000 gallons per year (13,425 gallons per day).

Area of Impact:
The AOI for an aquifer is the areal extent of each aquifer where one foot or more of drawdown is predicted to occur as a result of the proposed withdrawal. The results from the Theis analytical simulation, with the parameters listed above, do not simulate an AOI in the Potomac aquifer because the simulated drawdown at the production wells is less than one foot.

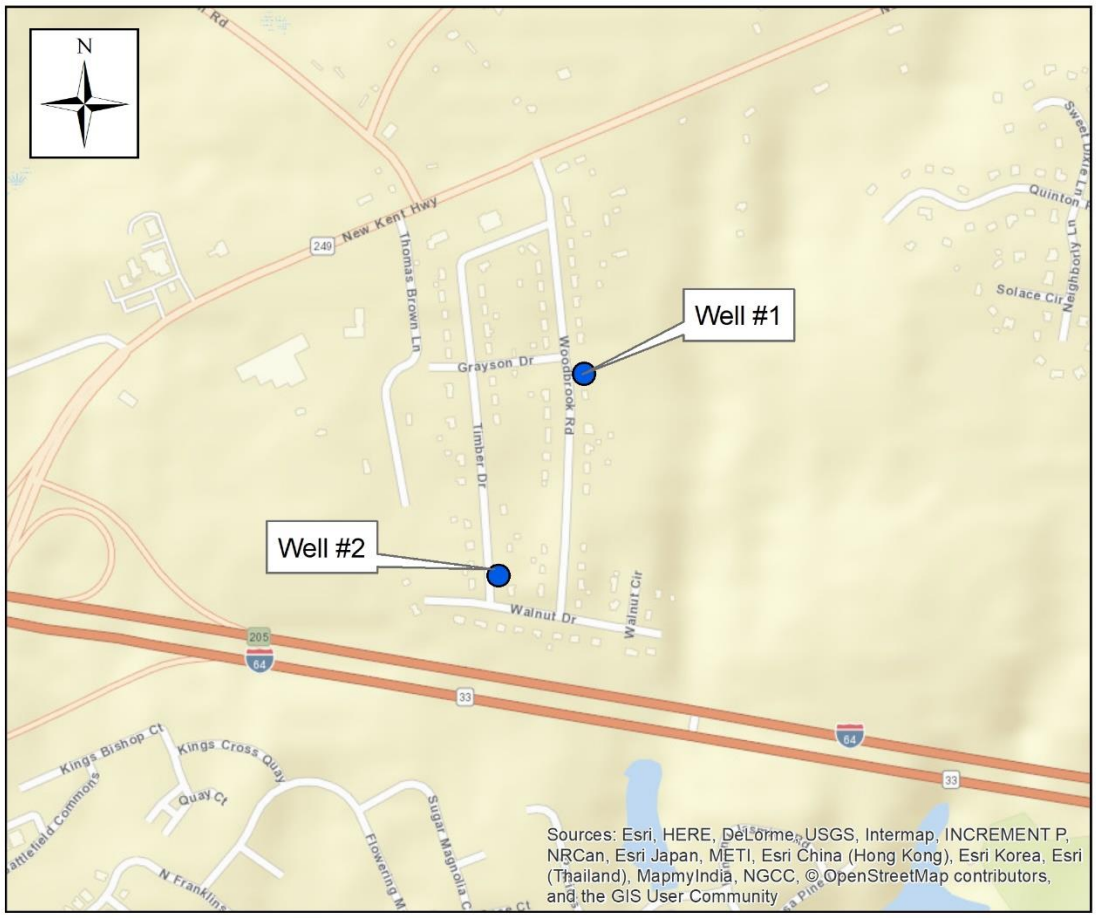
Water Quality:
The regional model (VAHydroGW-VCPM) does not indicate any changes to regional flow patterns that would lead to reduced water quality.

80 % Drawdown:
With no area of impact, this withdrawal is within the limits set by the 80% drawdown criterion.

The requested withdrawal is allocated 100% to the Potomac aquifer. The technical evaluation analysis indicated that the apportionment of the requested withdrawal amount among the applicant production wells had no significant effect on the outcome of the technical evaluation.

Conclusion:
The withdrawal requested by Aqua Virginia, Inc. for Brookwood Manor Public Water System satisfies the technical evaluation criteria for permit issuance.

Brookwood Manor Public Water System
Area of Impact - Potomac Aquifer



Brookwood Manor Public Water System Wells

Potomac AOI

Potomac Aquifer Critical Cells

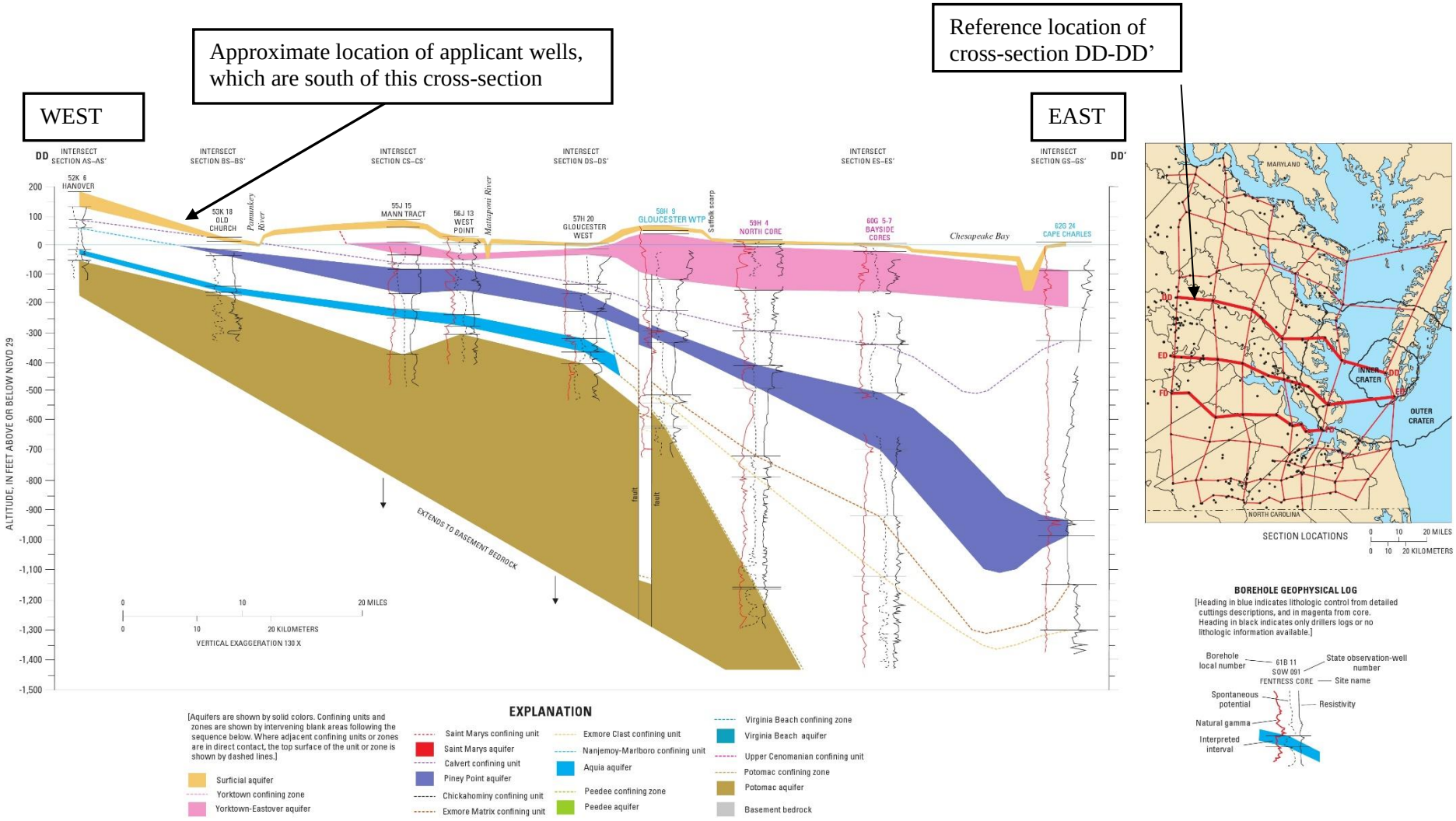
Simulated drawdown at or exceeding one foot in the Potomac aquifer resulting from a withdrawal of 4,900,000 gallons per year for 50 years from the Potomac aquifer using a two-dimensional Theis (1935) simulation.

Simulated drawdown is less than one foot.

0 0.075 0.15 0.3 Miles

Technical Evaluation performed by Aquaveo, LLC for the Virginia DEQ, Office of Water Supply Planning
March 22, 2023

DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY



Coastal Plain (2006) Cross-Section DD-DD' from USGS Professional Paper 1731.

WATER CONSERVATION AND MANAGEMENT PLAN

AQUA VIRGINIA
BROOKWOOD MANOR PUBLIC WATER SYSTEM
NEW KENT COUNTY, VA

January 2021

Prepared for:
Brent Hutchinson
Manager, Environmental Compliance I
Aqua Virginia
2414 Granite Ridge Road
Rockville, Virginia 23146

Prepared by:
Claire Archer
Hydrogeologist
Cardno
10988 Richardson Road
Ashland, VA 23005
www.cardno.com

Table of Contents

1 Introduction

On behalf of Aqua Virginia (Aqua), Cardno, Inc. (Cardno) has prepared this Water Conservation and Management Plan (WCMP) pursuant to Virginia's Groundwater Management Act of 1992 (Title 62.1, Chapter 25) and corresponding Groundwater Withdrawal Regulations (9VAC 25-610), which require a Groundwater Withdrawal Permit (GWWP) for any entity located within either the Eastern Virginia or Eastern Shore Groundwater Management Area (GWMA) that withdraws 300,000 gallons of groundwater or more in any one month. This WCMP has been prepared in conjunction with the GWWP application for the Brookwood Manor Public Water System (the system). The system provides public water service to the Brookwood Manor subdivision in New Kent County, Virginia.

In 2010, New Kent County developed the *New Kent County Water Supply Plan* (WSP; New Kent County Department of Public Utilities, October 2010). The WSP includes a section on Water Demand Management and a Drought Response and Contingency Plan, both of which are components of a WCMP. These sections of the WSP have been incorporated into this WCMP.

1.1 WCMP Requirements

A complete WCMP must satisfy the minimum requirements of 9VAC 25-610-100. For municipal and non-municipal public water supplies such as the Brookwood Manor system, the WCMP shall include the following:

1. Where practicable, the plan should require use of water-saving equipment and processes for all water users including technological, procedural, or programmatic improvements to the facilities and process to decrease the amount of water withdrawn or to decrease water demand. The goal of these requirements is to assure the most efficient use of groundwater. Information on the water-saving alternatives examined and the water savings associated with the alternatives shall be provided. Also, where appropriate, the use of water-saving fixtures in new and renovated plumbing as provided in the Uniform Statewide Building Code (13VAC-63) shall be identified in the plan;
2. A water loss reduction program, which defines the applicant's leak detection and repair program. The water loss reduction program shall include requirements for an audit of the total amount of groundwater used in the distribution system and operational processes during the first two years of the permit cycle. Implementation of a leak detection and repair program shall be required within one year of the date the permit is issued. The program shall include a schedule for inspection of equipment and piping for leaks;
3. A water use education program that contains requirements for the education of water users and training of employees controlling water consuming processes to assure that water conservation principles are well known by the users of the resource. The program shall include a schedule for information distribution and the type of materials used;
4. An evaluation of water reuse options and assurances that water shall be reused in all instances where reuse is practicable. Potential for expansion of the existing reuse practices or adoption of additional reuse practices shall also be included; and
5. Requirements for mandatory water use reductions during water shortage emergencies declared by the local governing body or water authority consistent with §§15.2-923 and 15.2-924 of the Code of Virginia. This shall include, where appropriate, ordinances in municipal systems prohibiting the waste of water generally and requirements for providing for mandatory water use restrictions in accordance with drought response and contingency ordinances implemented to comply with 9VAC25-780-120 during water shortage emergencies. The water conservation and management plan shall also contain requirements for mandatory water use restrictions during water shortage emergencies that restricts or prohibits all

nonessential uses such as lawn watering, car washing, and similar nonessential residential, industrial, and commercial uses for the duration of the water shortage emergency. Penalties for failure to comply with mandatory water use restrictions shall be included in municipal system plans.

Additionally, facilities with a GWWP are required to maintain a record logging the dates that activities required in the WCMP are completed. These logs are to be made available to DEQ staff upon request.

The above enumerated requirements are addressed in each subsequent section of this WCMP.

2 Overview of Water System

2.1 Description of Water Use

The Brookwood Manor system provides potable water to the residents of the Brookwood Manor subdivision. The subdivision is comprised of 76 lots, all of which are occupied and connected to the system (active connections) as of the date of this WCMP. This water is primarily used for drinking water, bathing, cooking, dishwashing, sanitation (toilets and lavatories), cleaning, and laundry. A small percentage of groundwater is used for non-essential purposes such as vehicle washing, lawn and landscape irrigation, and filling of swimming pools. Some water will be used as needed for flushing water lines.

2.2 System Design and Operation

The system currently utilizes two groundwater wells at two well facilities: Well #1 and Well #2, both screened in the Potomac Aquifer. Groundwater from each well is treated with sodium hypochlorite (for disinfection). Well #1 delivers water to two 119-gallon bladder tanks that provide pressure into the distribution system. Well #2 delivers water into a 20,000-gallon gravity storage tank, which subsequently feeds into a 2,000-gallon hydropneumatic tank providing pressure into the distribution system.

2.3 Proposed / Planned System Modifications

The Brookwood Manor subdivision is completely built-out, so there is no potential for additional customers to connect to the water system in the future. All 76 connections are to lots zoned as single-family residential.

2.4 Water Usage by Type

As part of the GWWP application for the Brookwood Manor system, a breakdown of beneficial uses of groundwater was developed. Of all groundwater used, the vast majority is for residential human consumptive use, which includes drinking water, showers, laundry, cooking, dishwashing, and fire suppression as needed. The remaining water usage will include non-essential activities such as vehicle washing and lawn watering, except during water shortage emergencies. Some water will be used as needed for flushing water lines.

2.5 Water Usage Schedule

The Brookwood Manor service area currently experiences moderate seasonal variations in water demand associated with increased summer water use. The last 11 years of usage data analyzed by Cardno indicate that peaks in usage occur during June-August, whereas in winter months (December- March) usage is lower.

3 Water-Saving Equipment and Processes

3.1 Water-Saving Equipment

On the production side, existing and any new system equipment including pumping and storage components as well as water main piping will adhere to the requirements of the Virginia Waterworks Regulations. Water uses such as distribution system flushing are only performed if required. If practical, water use while flushing will be minimized by regulating valves within the distribution system to increase flow velocities and reduce water use. As equipment is replaced within the system, water saving alternatives will be evaluated and used if applicable. Water savings in treatment and filtration systems, flushing activities, and plumbing fixture upgrades may be possible and will be evaluated. System improvements will be assessed regularly as new technologies become available that will allow water savings, along with providing system operators with continuing education on maintaining the water system and improving water system efficiencies.

On the consumption (customer) side, new construction, maintenance, and renovations must adhere to the Virginia Uniform Statewide Building Code (USBC). The USBC promotes efficient water use by specifying limits on flow rates for plumbing fixtures and public lavatories in new or renovated structures. Through the Water Use Education Program (Section 5 below), Aqua will encourage customers to use water-saving equipment including recommendations to choose fixtures with the U.S. Environmental Protection Agency (EPA) WaterSense label. Manufacturers design and produce innovative water-saving products that earn the WaterSense label by meeting or exceeding EPA criteria for efficiency and performance in specific product categories.

3.2 Water Use Monitoring

The production wells are metered, and water production is recorded on a weekly basis. Accounting for water usage from connected customers allows for greater understanding of usage amounts and temporal patterns, and can help a centrally controlled system distinguish between typical water usage fluctuations and potential leaks. All existing active connections are individually metered and any new connections will also be metered. Sub-metering allows Aqua to account for water usage and to promote water conservation through water use education and demand management.

3.3 Billing Incentives

Aqua issues water bills to all customers on a monthly basis. Billing statements to customers can incentivize water conservation behaviors. A recurring and frequent billing statement provides information to the customer concerning base rates for water consumption, and can encourage less water use, as higher usage incurs larger water bills. Including a customer's water use data with each billing cycle will demonstrate how water saving practices such as installing efficient plumbing fixtures have tangible financial benefits. Customers can also identify how certain seasonal non-essential activities such as watering lawns increases water consumption and associated costs.

The current rate structure strategy is to bill customers a base rate for zero gallons and then bill for every gallon used, rounded to the nearest thousand gallons. The cost to the customer is lower for low water use and increases for higher water use. The customer's water consumption is provided on the customer's bill for each billing cycle.

4 Water Loss Reduction Program

Water loss reduction pertains to those areas of the water system where the loss of water is reduced by promptly identifying and attending to system leaks, maintaining water use monitoring programs, and maintaining a preventive maintenance program.

4.1 System and Customer Metering

Monitoring water use is necessary for a successful water loss reduction program. The only viable means of effectively monitoring water use is through the installation of water meters. Strategically placed water meters can differentiate those areas of high use from those areas of moderate or low use. Water metering and an effective reading system enables operators to pinpoint areas of high water loss. Customer meters are also physically inspected, where operators can detect damaged or faulty meters and make repairs and replacements as necessary.

Aqua reads well meters on a weekly basis and all customer meters on a monthly basis. Customer meters are touchless radio-read, which allow for expeditious analysis of customer water use and notification to system operators of unusual usage patterns (e.g., high water use during off-season, abnormally high usage trends) that could indicate the presence of a leak.

4.2 Unaccounted for Water Analysis

Usage data collected from customer and system meters will allow for an accounting of water produced and water consumed. Water system audits will be performed by comparing well and customer usage data and analyzing differences to identify major leaks or discrepancies. Currently, this analysis will occur not less than once annually to establish the system base line for error within metering equipment. More frequent water audits will be performed if water use trends indicate potential leaks. System water use will be reviewed during each pump house visit, on each monthly operator's report, the quarterly usage report, and annually on an unaccounted for water analysis. More frequent reviews may be possible as new technologies are implemented within the meter reading systems.

4.3 Water System Leak Detection and Repair

When a leak in the system is detected, it will be repaired as quickly as possible, typically within 24 hours. Leaks may be detected through the audit analysis described above, especially in cases where visible signs of a leak are not apparent. Excessive or unexpectedly high monthly customer water usage identified through the monthly billing process can be indicative of leaks and will initiate leak investigation procedures. Metered customers will be responsible for internal plumbing maintenance and leaks (e.g., household piping and fixtures or a larger customer's internal water mains). Aqua can suspend water service in cases of unresolved leaks where the customer is unresponsive or significant water is wasted.

Searches for leaks include walking system lines to look for potential leak indicators such as puddles or wet areas. Electronic equipment is used for subsurface leaks not identified on the surface, including sonic devices. Additionally, simultaneous monitoring at multiple points, isolating valves, and isolating sections of the distribution system are used to help pinpoint exact leak locations.

Aqua operators will inspect all pump station piping for leaks during each visit and operators will notify management of any leaks observed in the pump station or on the distribution system in a timely manner. During monthly meter readings, operators will observe customer piping for leaks and make note of any leaks observed. Observed leaks will then be reported to Aqua's billing staff. Aqua will subsequently notify the customer that a plumbing leak has been observed on their property. Such a notification will generally occur within five (5) business days. Depending on the severity of the leak, the operator may also notify the customer directly.

Upon identification of a subsurface leak not identified on the surface, sonic electronic and electromagnetic leak detection equipment will be used. These methods will be used in conjunction with simultaneous flow monitoring at multiple points, isolation of valves, and isolation of sections of the distribution system to help pinpoint exact leak location(s).

Additionally, Aqua recently developed an Excel-based water production tracking program to aid in leak detection and GWWP limit compliance. Upon entering weekly well production data, the program performs a series of calculations to identify abnormally high water production and to forecast if monthly GWWP limit exceedances could occur. The program works by comparing system water production in gallons per day (gpd) to the maximum and average production in the previous calendar year. Instances of production more than 20% higher than the maximum produced in the previous year are highlighted, notifying Aqua of a potential leak. Aqua has utilized this program since April 2019. So far, this program has identified leaks that may have otherwise gone unnoticed at several of Aqua's systems.

4.4 Preventive Maintenance

Aqua will maintain its water production, storage, and treatment facilities and distribution system in accordance with the Virginia Waterworks Regulations and industry standards to prevent leaks. Preventive maintenance will include winterization of any system piping or fittings exposed aboveground that do not yet have connections to prevent freezing, breakage, and subsequent leaks. Customer meters will be replaced at a rate such that a complete system-wide turnover occurs every 15 years, which is consistent with the warranty period on most meters.

System customers will be responsible for conducting preventive maintenance of their plumbing beyond the meter. This includes winterizing their buildings and plumbing systems by draining water lines as necessary to prevent freezing, breakage, and subsequent leaks.

Aqua may provide regular reminders of the requirements for preventive maintenance in customer billing statements issued one to two months before the onset of winter. Aqua operators who observe potential issues associated with lack of maintenance (e.g., unoccupied buildings without appropriate winterization) will notify billing staff. Billing staff will then notify the customer within five business days. Aqua reserves the right to discontinue service to a customer who does not take appropriate actions to prevent leaks or wasting of water.

5 Water Use Education Program

Education of customers and operators is an essential component of an effective water conservation program.

5.1 Customer and Public Education

Public awareness and customer education is essential for an effective conservation program. The goal of a conservation awareness program is to make the customer understand their water sources, the costs of supplying the water to the customer, the problems associated with supplying water, and how changes in consumer behavior can lower the cost of supplying water and thereby lower the cost to the customer. Establishing conservation practices by customers through education and financial benefits can modify long-term water use patterns. Information on water saving practices that will lower costs, including low-flow fixtures, water conservation, and repairing leaks are measures the customers will notice.

Aqua will include in the Consumer Confident Report mailed to customers in March each year links to Aqua's Water Smart website (http://www.aquawatersmart.com) dedicated to water conservation and water saving techniques. Information on the website is updated periodically. The educational information provided addresses the need to conserve, the advantages of water saving devices, information on new water saving devices, and indoor and outdoor water conservation practices. Information may also include outdoor best management practices such as planting drought tolerant and low water use vegetation, efficient irrigation, mulching, limiting turf areas and re-using water where applicable. Links to internet sources of water conservation information such as the EPA WaterSense website (www.epa.gov/watersense) will also be included with the mailings. Aqua will evaluate providing links to educational information sources with all billings. If feasible, the links may be targeted based on the customers water use.

5.2 Operator and Management Education

The water system is maintained by licensed Waterworks Operators. The licensed operators are specifically trained in leak detection and water distribution system repairs and are required to attend a minimum of 16 hours of professional education per two-year cycle to maintain certification. Additional job training specific to water conservation is provided on an as-needed basis. Aqua's operators are made aware that water losses in the distribution system represent lost revenue and should be repaired promptly.

5.3 Outdoor Water Use Education

Landscape irrigation and outdoor water uses can increase water use significantly in the summer months. This trend is observed for water systems that typically have large landscaped lots or in-ground irrigation systems. Water use may be reduced by modifying the outdoor water use habits of the residents through education. High water use customers and customers of water systems with high summer residential demand would benefit the most. Customers will be provided with links to information sources on Aqua's Water Smart website specific to managing outdoor water use and irrigation practices as the information is periodically updated, such as the following water saving tips:

- Water your lawn only when it needs it. Simply walk across the grass to see if it needs water. If you leave footprints, it's time to water
- Water in the early morning. Nearly 30 percent of water can evaporate when watering at midday. Don't water your lawn on windy days
- Deep soak your lawn instead of frequent sprinklings that evaporate quickly
- Set your lawn mower one notch higher to limit evaporation
- Check sprinkler heads and valves for leaks and adjust the timer according to seasonal water needs and weather conditions
- Plant for your climate. Native and drought-tolerant plants might have lower water needs. A local nursery can help you plan a water-wise garden
- Use mulch around plants and shrubs to save moisture
- When using a hose, control the flow with an automatic shut-off nozzle
- Use a broom, instead of a hose, to clean sidewalks and driveways
- When washing your car, use soap and water from a bucket, along with a sponge and hose with a shut-off valve
- Disconnect hoses and make sure outdoor water is shut off during cold weather to prevent leaks
- If you have a swimming pool, get a cover. You'll cut the loss of water by evaporation by 90 percent
- Eliminate shrub bed irrigation for established landscaping
- Maintain automated irrigation systems controls to limit overwatering
- Repair significant leaks quickly to minimize the loss of water

6 Water Reuse

Currently, no significant water reuse options are available for the Brookwood Manor system. Most system use is for public consumption, requiring the highest quality and conformance to drinking water quality standards. The

Virginia Department of Health is currently opposed to potable reuse where naturally occurring sources of water are available. Wastewater is treated and returned to the Surficial aquifer through individual septic systems.

7 Requirements for Mandatory Water Use Restrictions

The Brookwood Manor system will comply with any mandatory water use restrictions during water shortage emergencies declared by New Kent County or the Commonwealth of Virginia. The *New Kent County Water Supply Plan* (WSP, 2010) includes a Drought Response and Contingency Plan in accordance with 9VAC 25-780-120.

7.1 Drought Stages

Drought conditions in Virginia are monitored by the Drought Monitoring Task Force (DMTF), which is led by DEQ in conjunction with the State Climatologist. Recommendations for curtailment of water use are a result of drought conditions as reported by the DMTF. The DMTF does not demand the curtailment of water use but advises the waterworks owner on conditions that may warrant concern.

The DMTF has developed a Drought Monitor ranking system, ranging from normal to dry to exception drought conditions. Drought conditions vary in severity. Therefore, it is best to classify the actions to be taken with respect to the curtailment of water use and conform those severity levels to the Drought Monitor. Drought stages may be declared by the Virginia Drought Coordinator, localities, or individual water system managers. Drought Emergencies may also be declared for the entire state of Virginia or the Eastern Shore Region by the governor. Depending on the drought severity level, the action taken could range from no action to the most restrictive water conservation measures. Drought severity levels are determined by guidelines contained in Section 6.0: Drought Response and Contingency Plan in the *New Kent County Water Conservation and Management Plan* (County WCMP, 2008) and are cited in Section 5.2: Drought Response in the New Kent County Water Supply Plan (WSP, 2010). The following severity codes are to be followed:

7.1.1 Normal

Normal conditions dictate no special response. During normal conditions, the jurisdiction continues to monitor drought conditions.

7.1.2 Drought Watch

Drought Watch responses are intended to increase awareness to climatic conditions that are likely to precede the occurrence of a significant drought event. During this stage, preparations are made for the onset of a drought event.

7.1.3 Drought Warning

Drought Warning responses are required when the onset of a significant drought event is imminent. Water conservation and drought contingency plans begin to be implemented. Water conservation at this stage would generally be voluntary, and may reduce water use by 5 to 10%.

7.1.4 Drought Emergency

Drought Emergency responses are required during the height of a significant drought event. During these times, non-essential uses of water should be eliminated. Mandatory water conservation requirements contained in water conservation and contingency plans are initiated at this stage, and generally result in water use reductions of 10 to 15%.

7.2 Drought Monitoring and Water Use Restrictions

Aqua will monitor drought conditions through Virginia's DMTF and the Drought Monitor, as well as locally through water levels in Brookwood Manor production wells as available. In the event of an actual or anticipated shortage of potable water due to climatic, hydrological, mechanical, and/or other extraordinary conditions, Aqua may determine that certain uses of water should be reduced, restricted, and/or prohibited. Aqua will notify the Virginia Department of Health if it declares any level of drought condition for the Brookwood Manor system. In the case of a self-declared Drought Emergency, Aqua will also notify the Virginia Emergency Operations Center.

The following sections outline the Drought Response and Contingency Plan contained in the *New Kent County Water Conservation and Management Plan* (County WCMP, 2008), as enforced by Section 38-97 of the New Kent County Code, and how Aqua will abide by the plan. These use restrictions are short-term compared to the normal full-time water conservation programs outlined in this WCMP, and are only implemented during periods of drought when adequate water supply may be threatened.

7.2.1 Drought Watch

When a Drought Watch is declared, Aqua will:

1. Review existing drought water conservation and contingency plans and
2. Make reasonable efforts to pursue leak detection and repair programs.

If Aqua self declares a Drought Watch for the Brookwood Manor system, it will also:

3. Inform the VDH of their self-declared drought watch; and
4. Issue a press release indicating the reasons for the declaration.
5. Encourage Tier 1 Voluntary Water Use Restrictions, listed below (Section 5.2 in the *New Kent County Water Supply Plan* (WSP, 2010)):

   • Voluntary water conservation measures will be encouraged. Voluntary use restrictions are employed as a first stage in reducing water demands during a water shortage. These constraints are designed to limit water use for nonessential uses, such as outdoor water uses (e.g., car washing, and lawn watering).

   • A public awareness and information process will be implemented to distribute additional water conservation information and other special notices to the public water system customers. Industrial and commercial users will be asked to initiate internal conservation plans.

   • The County may delay landscape installation for new construction with a bond when drought declaration is evoked. This is in addition to voluntary water conservation measures.

7.2.2 Drought Warning

When a Drought Warning is declared, the affected population and entities may be called upon to employ prudent restraint in water usage and to conserve water voluntarily by whatever methods available. Under this condition, Aqua will notify system customers through its website and/or monthly billing statements of the Drought Warning and remind customers of the implementation of mandatory water conservation measures by the county. These mandatory restrictions include:

• The watering of shrubbery, trees, lawns, grass, plants, or any other vegetation is not permitted, except indoor plantings, greenhouses, or nursery stocks, or from a bucket or other containing not exceeding three (3) gallons in capacity and except watering by commercial nurseries of plants freshly planted and once a week for five weeks following planting or until the drought emergency declaration is revoked.

• Washing of automobiles, trucks, trailers, boats, airplanes, or other types of mobile equipment is not permitted except in facilities operating with a water recycling system approved by the Department, or except from a bucket or other container not exceeding three (3) gallons in capacity. Provided, however, that any facility operating with an approved water recycling system shall prominently display in public view a notice stating that such system is in operation. In lieu of the provision hereof, the County Board may curtail the hours of operation of commercial enterprises offering such services or washing their own equipment.

• Washing of streets, driveways, parking lots, service station aprons, office buildings, the exterior of homes or apartments, or other outdoor surfaces by commercial washing/cleaning services is not permitted except from a bucket or other container not exceeding three (3) gallons in capacity.

• The operation of any ornamental fountain or other structure making similar use of water is not permitted.

• The filling of swimming and/or wading pools, or the refilling of swimming and/or wading pools that were drained after the effective date of the declaration is not permitted.

• The use of water from fire hydrants for any other purpose than fire suppression or other emergency is not permitted except as authorized by the Department.

• Serving of water in restaurants, except upon request of customers, will not be permitted.

Under this condition, Aqua will continue to monitor water levels in the Brookwood Manor system and work with the County to monitor the DMTF report for changes in the severity level of the drought.

7.2.3 Drought Emergency

When a Drought Emergency is declared, the County Administrator in consultation with Aqua is authorized to impose additional restrictions or prohibitions to reduce water demand, and to adopt whatever restrictions are imposed by the governor.

Specific conditions regarding the prohibitions and restrictions listed above are contained in the *New Kent County Water Supply Plan* (WSP, 2010). If these prohibitions and restrictions are insufficient in protecting the system's water supply, water may be rationed. The decision to begin rationing water may be made by the County or Aqua. Under rationing, the following emergency actions will be implemented:

• The New Kent County Department of Public Utilities shall allocate water to customers based on a reduction of either the average consumption of their last 12 months billing or water consumption data available from similar activities of equal intensity.

- Residential, Industrial, commercial, and school water use shall be reduced by 25% of normal consumption.
- The amount of water allocated shall not be less than fifty (50) gallons per person per day per household.

• Increased water rates of 300% will be charged for water use in excess of the conservation goal.

• Installation of new water service connections will be suspended.

• Application for appropriate state or federal drought emergency grants will be submitted.

Under Drought Emergency conditions, Aqua will consult with the County Administrator and the Virginia Department of Health prior to enacting the above restrictions on its customers. Then, Aqua will notify all customers of these mandatory water use restrictions via its website, by a special mailing to customers, and/or by public notice in a local newspaper.

If required to issue water restrictions enacted by the local government, Aqua's tariff provides them the authority to perform water service shut-offs for non-compliance:

RULE NO. 10 – DISCONTINUANCE OF SERVICE

(a) Service may be discontinued (turned off) by the Company after ten (10) days written or printed notice for any of the following reasons:

1. *For abusing or tampering by the customer, or others with the knowledge of the customer, with any meters, connection, service pipe, meter cock, seal, or any other appliance of the Company controlling or regulating the customer's service.*
    i. *If meter removal occurs due to tampering, the customer will be assessed the applicable reconnection charge per the Schedule of Rates & Fees at the time of service restoration, plus applicable costs incurred, including labor and overhead, for any required repairs to the utility's property. Service restoration will occur when the account is paid in full.*
    ii. *Meter tampering is also a criminal offense and violators will be prosecuted.*
2. *For failure to provide the Company's employees free and reasonable access to the premises supplied, or for obstructing the way of ingress to the meter or other appliances controlling or regulating the customer's water supply.*
3. *For non-payment of any account ten (10) days past due for water supplied, or for any fee or charge accruing under these Rules and Regulations and the effective Schedule of Rates.*
4. *For violation of any rule or regulation of the Company.*
5. *For failure to comply in any way with the Company's cross-connection and backflow prevention control program.*

7.3 Declaration of End of Water Emergencies

In the case of locally declared emergencies, the County Administrator, in consultation with Aqua, shall notify the Board of Supervisors when, in their opinion, the water emergency situation no longer exists. *The New Kent County Water Supply Plan* (2010) states that a drought emergency declaration shall be lifted "when the precipitation deficit has fallen below the trigger levels for each increased stage of drought severity and has remained below that level for fifteen (15) consecutive days, or by mutual agreement between the New Kent County Board of Supervisors and Department of Public Utilities; but not before the declaration of water emergency is lifted by the Executive Director of the Department of Environmental Quality in accordance with the Groundwater Management Act."

Upon concurrence of the Board of Supervisors, the water emergency shall be declared to have ended. Then, Aqua will notify all customers of the cessation of any mandatory water use restrictions via its website, by special mailing to customers, and/or by public notice in a local newspaper.

In the case of state-wide or regional emergencies, the emergency will end upon order of the governor.

8 WCMP Effectiveness Reporting

By the end of years five and ten of the GWWP term, Aqua will develop a report on the effectiveness of this WCMP. This will include revisions to those elements of the WCMP that can be improved and addition of other elements found to be effective based on operations to-date. These reports shall include:

- Any new water-saving equipment installed or water-saving processes adopted.
- WCMP actions taken to reduce the volume of water needed to supply the system.
- Planned short or long-term efforts and actions to be added to the WCMP to improve the efficiency of water use in the system and for reducing the loss of water.
- Results of additional water audits completed.
- Evaluation of the leak detection and repair program.
- Description of educational activities completed.
- Identification of any water reuse opportunities identified.